

Observations upon the Artificial Fertilization of Oyster-eggs, and on the Embryology of the American Oyster. By W. K. BROOKS, Associate in Biology, Johns Hopkins University.

All the writers upon the development of the oyster, from Home (Phil. Trans. 1827) to Möbius (Austern und Austernwirthschaft, 1877), state that the eggs are fertilized inside the shell of the parent, and that the young are carried inside the mantle-cavity until they are provided with shells of their own, that they leave the parent in a somewhat advanced state of development, and that their free-swimming life is of short duration and lasts only until they find a suitable place to attach themselves.

Misled by these statements, which do not apply to our species, I opened a number of oysters during the summer of 1878 and examined the gills and the contents of the mantle-chambers for young, but found none, and concluded that the time during which the young are carried by the parent must be so short that I had missed it. I undertook the same investigation this May, with the determination to examine adult oysters for young every day during the breeding-season, and at the same time to try to raise young for myself by the artificial fertilization of eggs taken from the ovaries. I had complete success with the second method from the first, and succeeded in raising countless millions of young oysters, and in tracing them through all their stages of development up to the time when they had acquired all the characteristics which Salensky, Lacaze-Duthiers, Möbius, and others have figured and described in the young European oyster at the time it leaves its parent. I also made careful examination of the gills and mantles of more than a thousand oysters, but never found a single fertilized egg or embryo inside the mantle-cavity of an adult, although I found females with the ovaries full of ripe eggs, others with the ovaries half empty, others with them almost entirely empty, and others at all the intermediate stages; and I therefore feel sure that my examinations were made upon spawning oysters.

While this evidence is only for one season and one bed, I think that, until it is shown to be exceptional, we must conclude that there is an important difference in the breeding-habits of American and European oysters, and that the eggs of the American oyster are fertilized outside the body of the parent—that during the period which the European oyster passes inside the mantle-cavity of the parent, the young American oyster swims at large in the open ocean.

The more important points in the development of the oyster are:—

1. The oyster is practically unisexual, since at the breeding-season each individual contains either eggs or spermatozoa exclusively.

2. Segmentation takes place very rapidly, and follows substantially the course described for other Lamellibranchs by Lovén and Fleming.

3. Segmentation is completed in about two hours, and gives rise to a gastrula, with ectoderm, endoderm, digestive cavity and blastopore, and a circle of cilia or velum. At this stage of development the embryos crowd to the surface of the water and form a dense layer less than $\frac{1}{4}$ inch thick.

4. The blastopore closes up; the endoderm separates entirely from the ectoderm; and the two valves of the shell are formed, separate from each other, at the edges of the furrow formed by the closure of the blastopore.

5. The digestive cavity enlarges and becomes ciliated; and the mouth pushes in as an invagination of the ectoderm at a point directly opposite that which the blastopore had occupied. The anus makes its appearance close to the mouth.

6. The embryos scatter to various depths, and swim by the action of the cilia of the velum. The shells grow down over the digestive tract and velum; and the embryo assumes a form so similar to various marine Lamellibranch embryos which are captured by the dip-net at the surface of the ocean that it is not possible to identify them as oysters without tracing them from the egg. The oldest ones which I succeeded in raising in aquaria were almost exactly like the embryos of *Cardium* figured by Lovén.

7. The ovaries of oysters less than $1\frac{1}{2}$ inch in length, and probably not more than one year old, were fertilized with semen from males of the same size, and developed normally.

An illustrated paper on the embryology of the oyster, with a detailed account of my observations, will be published, shortly, in the Report of the Maryland Fish Commission for 1879.—*Amer. Journ. Sci. and Arts*, December 1879, pp. 425-427.

Observations on the Salivary Glands of the Echidna.

By M. H. VIALLANES.

From the anatomical arrangement of the different glandular masses which produce the saliva we may distinguish in the Echidna the three groups of glands which are met with in most Mammalia, namely:—1, the *parotid glands*; 2, the *submaxillary glands*; 3, the *sublingual glands*.

The parotid glands, which are so constant in the Mammalia, escaped the notice of Cuvier and R. Owen; the latter even formally denies their existence. I have found the parotids well developed in the Echidna; but instead of being situated in front of the auditory passage, they are situated far back, at the middle of the neck.

In the Echidna there are on each side two submaxillary glands—one deep-seated, the other superficial. The deep-seated submaxillary gland has been well described by Cuvier and Owen. Its excretory duct passes directly forward, and pierces the great transverse muscle which forms the superficial layer of the floor of the mouth.